3: Robequain--260 S-5 (no date) 1944 Laotians
116, 135, 316, 439, 471

"For the past several years the production of tin in the Nam Patène basin in Laos has exceeded that at Pia Ouac. The Nam Patène River is a left hand tributary of the Nam Hin Boun, which itself flows into the Mekong at Pak Hin Boun, north of Thakhek. Cassiterite has been mined here from time immemorial by the Laotians who dug small shafts a few meters deep into the alluvium. Native mining continues today on the European concessions, the ore being purchased by the companies. Formerly, after careful sorting, the richest particles were crushed, washed in cradles and reduced in Chinese charcoal-furnaces. But about 1920 production was still a mere ten to fifteen tons a year; it was exported to Thailand where it was used only as ballast for fish nets."

3: Robequain--260-261 S-5 (no date) 1944 Laotians
116, 135, 316, 471

"It was not until 1923 that the Société d'Études et d'Exploitations Minières de l'Indochine began to work the beds systematically. Veins had first been discovered in the eluvium and alluvium of a huge karstic basin some 30 kilometers long and 8 wide, cut into the Urals-Permian limestone which dominates it with dramatic masses and sheer, almost insurmountable slopes. The eluvial cassiterite is joined in depth to the veins which pass through the Muscovitic sandstone subjacent to the limestone, and which have been metamorphized by granite intrusions. Here it is not associated with wolfram as it is in Pia Ouac. It is about ten meters thick with a thin covering of unproductive soil; mining is quite easily performed by the open-pit method, under a 'cai's' direction. Almost all the ore extracted up to the present has come from the Phon Tiou bed on the Solange grant. The 1926-1929 boom brought about the formation of other companies whose grants are worked by the Compagnie Fermière des Étains d'Extrême-Orient. Production started in 1933 and is carried [261] on around Boneng. They have begun cutting out the veins, whose reddish chimneys stand out between their white sand-stone wells."

3: Robequain--261 S-5 (no date) 1944 Laotians
116, 135, 316, 402, 494

"Laos ore is harder to work than Tonkinese because of its lower metal content and the presence of considerable amounts of sulphurous and ferruginous matter. In addition, coal is scarce here: producer gas gazogenes run the dynamos which produce motive power, but they consume enormous quantities of wood, which must be cut farther and farther away from the mine. As a result, the ore has never been smelted on the spot. But mechanical processes for separating and purifying have gradually been set up at the mines. For example, after crushing and magnetic separation, very well-equipped washers prepare concentrates for export. Under sloping roofs, powerful machines stand in tiers one above another on the hillsides, so that the water and the gradually purified product itself are moved as much as possible by mere gravity from one process to another. The mud and rocks, which were dumped out of small wagons at the top of the mill, appear as black cassiterite crystals at the bottom where they fill little 35 or 50 kilogram sacks for shipment to Singapore. They are transported either via the Mekong or over the roads from Thakhek and Savannakhet to the Annam coast. Six thousand Annamites work in the tin mines of the Laos basin; though a few are Tonkinese most of them come from Nghê Tinh. Work is done by gangs and goes on continuously since the machines can be stopped only at great expense; at night this isolated basin, surrounded by rugged mountains and dotted with electric lights which furnish illumination for the coolies as they work to the accompaniment of the mills' unrelenting rhythm, is a striking picture."

3: Robequain--262 S-5 (no date) 1944 Laotians
116, 135, 316, 439

"More or less argentiferous lead ores are found together with zinc ores in most beds, and it was these for which the Chinese sought particularly. French companies have attempted to reopen the mines, particularly that at Ngan Son south of Pia Ouac, but without success. The Compagnie Minière et Métallurgique de l'Indochine exports a few tons of lead ore and some tens of kilograms of silver, mere by-products of the company's zinc mining."

10: d'Orleans--357-358 T-3 (1891-92) 1894 Laos
116, 135, 316

"There is a great deal of mineral wealth, in the Laos country, and among the many gold fields which might be worked to advantage are Pac Bay (above Luang Prabang), Xieng Mang, and Xieng Mon. There is an abundance of antimony, lead, copper, and iron, while there are agates and chalcedonies near Luang Prabang. Then, [358] in the neighbourhood of Kiangsen, there is a ruby mine belonging to the king of Nan, which is not yet worked, though a Burmese has applied for a concession."

133 The market of Bassac owes its importance to the proximity of the
433 plateau. It is therefore a storehouse for the Laotians of the whole
438 region, a reservoir [51] from which they draw. The part which it plays is obviously a fine one, and no more can be asked of it.

There has also been much discussion as to whether large-scale breeding of buffalo and oxen would be successful there, for at present livestock is found only in the villages situated near the Sédone, that is to say, quite far from the plateau. The question has not yet been settled, and sufficient tests have not yet been made.

133 At the southernmost corner of the plateau there is a conical mountain about 800 meters in altitude which Francis Garnier baptized The Breast [le Téton] because of its shape, and to which he later gave the name Lagrée's Peak [Pic de Lagrée] in commemoration of the President of the Exploratory Commission of 1866.

[224] The elephant hunters of southern Laos go to the mountainous region of Saravane and Attopeu every year, and there they capture an annual quota of fifty to a hundred elephants.

133 To the east of Attopeu the mountains are inhabited by well-
[177 nigh independent Kha tribes--Cédangs, Djarais, Rognaos and
797] Bahnars. The two latter tribes have almost been pacified, thanks to the persevering efforts of the Christian missionaries of Kon-Toum. This point is the center of the mission, and through it passes the road from Attopeu to Qui-Nhon. It crosses the Annamitic Chain
563 between Kon-Xalam and Kon-Tiorak at an altitude of about 900 meters. Near Attopeu this same road goes up over Pou-Satièng (400 meters), the last ramification of the great chain, which separates the basin of the Sé-Souk from that of the Sé-Kémane.

[135] This region of Pou-Satièng, Sé-Souk and Sé-Kémane has long been known to be rich in gold deposits.

§ IV--HYDROLOGY

a.--THE MÉKONG--GENERALITIES

133 It has often been said, and rightly so, that the Nile constituted Egypt. In the same way it can be said that the Mékong makes Laos, for is it not the river which gives what vitality there is to these vast isolated regions? Is it not the river which, by its annual floods, helps the growth of rice? Does it not supply, with its fish, a large

825 Elephant.....Ivory, teeth, toenails, bones, hide.
Tiger.....Pelts, talons, fangs, bones.
136 [314] Rhinoceros.....Hide, horns.
Bear.....Skins, gall (used in medicines).
Goat, otter, cayman.....Hides and skins.
Scaly anteater.....Scales and skin.
Buffalo, ox, stag, deer.....Hides, horns and antlers.
Peacock, marabou stork
and other birds.....Feathers.
Snakes.....Skins and venom.
Coccus (insect).....Crimson lake.
Bees.....Honey and wax.

3. MINERALOGY

a) Mineral Wealth

135 As we said above, the geological formations of Laos are similar in nature, rate of change and transformations undergone to those in the neighboring countries on the west, northwest and south. Everywhere there is the same original substratum, and this, together with the sediments which have formed in its folds, has been traversed, lifted and dislocated by volcanic thrusts which are less and less apparent as one moves away from the two eruptive nuclei located in the northwest and south, that is to say in Tibet and Malaysia. To be sure, the orographic nucleus which has had the greatest influence on the relief of the country and the formation of the various regions of Laos is the one which, in Tibet, has produced the long ridges of mountains between which the valleys of the great rivers of China, Burma and the Indo-Chinese peninsula have cut their paths.

In the basin of the Mekong, the only one with which we need be concerned here, there are secondary ridges brought about by partial upheavals or folds, which form a series of stepped plateaus and chains of valleys eminently suited to catching the sediment carried down from the peaks and to furthering its distribution in accordance with the laws of gravity. It is to this peculiar disposition that Laos owes its mineral wealth. During the course of centuries the partial dislocations, atmospheric agents, moving waters, etc. disaggregated, split and reduced [315] to stones, and then into gravel and soil, the mountain crests of eruptive rocks which contained gold, precious stones, silver-bearing galena, tin, copper, iron, etc. Once set free

135 by the destruction, pulverization and washing of their gangues, all these metal particles were deposited, merely by virtue of their density, in nearby beds and on the least inclined planes along the courses of the waters in which they were contained.

Moreover, because the soil of Laos has long been stable we find the mineral deposits covered with a comparatively shallow layer of sterile alluvia. Sometimes this layer is practically nonexistent, and it is always easy and inexpensive to work. In some points the lode-bearing deposits are even on the surface or only just below the alluvial deposits.

The list which follows will give some idea of the extensive mineral wealth in Laos. Because of a lack of means of communication and mechanical equipment, however, the exploitation of its forest, animal and vegetable resources will be delayed for some time. But although one might hesitate to come to Laos in order to experiment with the rich crops which would be suited to its warm, damp climate and its virgin soil, we believe that the exploitation of its mineral deposits is of such a nature as to tempt French capitalists who, if they operate prudently, can be assured of reaping rich rewards in a short length of time for their effort and their initiative.

316 Here is an enumeration of the mineral wealth of Laos, based on the most recent information.

1. Gold Mines

A. Deposits of Nam-Beng and Nam-Ngao (province of Luang-Prabang).	Prospected in 1895 by Mallet and Isnard, engineers.
B. Deposits of Nam-Poun, (Outhai-Thani, Luang-Prabang, right bank).	Goldbearing gravel prospected in 1899 by M. Macey, government commissioner.
[316] C. Deposits of Tran-Ninh.	Prospected in 1895 by a private company.
D. Deposits of Ban-Tong-Ak (Upper Nam-Teun, province of Cammon) and of Vang-Kham (same province)	Deposits noted but not yet prospected.